Rejection of Claims under 35 USC §103

Claims 1-7, 16-22, 29-32, 36, 39, 40, 42, 43, 49-51, 57-66, 69, 70, 85, and 86 are rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 6,289,414 to Feldmeier et al (Feldmeier) in view of U.S. Patent No. 6,502,163 to Ramankutty (Ramankutty). Applicants respectfully traverse these rejections.

Claims 1-28

Applicants' Claim 1 recites:

A content addressable memory (CAM) system including an array of binary CAM cells segmented into a plurality of array groups, each array group having a group global mask for storing a mask pattern indicating priority of the array group.

Neither Feldmeier nor Ramankutty, whether taken alone or together, suggests the CAM system recited in Applicants' Claim 1.

As discussed earlier in Applicants' response dated April 21, 2003, Feldmeier discloses storing address entries in a CAM array according to mask or priority number so that address entries having the same mask number are grouped together, with the addresses having the highest mask numbers stored in the lowest CAM addresses (see col. 10, lines 55-65). A sorting algorithm is required to maintain proper ordering of the groups of address entries (see col. 11, lines 50-65 and col. 14, lines 28-41). Each group of address entries in Feldmeier's CAM array corresponds to an address space that is defined by a "Floor" address and a "Blocksize" parameter (see col. 15, lines 1-35). The address space assigned to each group of entries can be changed to make room for more entries by adjusting the group's Floor address and/or Blocksize parameter, thereby "shifting" the group of entries to a new address space (see col. 15, line 53 to col. 16, line 2). The IP mask numbers are logically combined with IP addresses when the address entries are stored in the CAM array, thereby encoding mask information within each address entry (see col. 12, lines 55-67). A single mask register 40 is provided for Feldmeier's entire CAM array (see col. 13, lines 2- 27 and FIG. 20).

The Examiner acknowledges that Feldmeier fails to disclose or suggest that each array group includes a group global mask that stores a mask pattern, and then states:

> However, Ramankutty discloses the array of binary CAM cells segmented into a plurality of array groups (Fig. 1 Ref 108-1 to 108-5), each array group having a group global mask for storing a mask pattern (col. 5, lines 25-30 and col. 10 lines 65+) for the purpose [of] providing capability of updating data values according to prefix length without having to re-order the entries in the CAM thereby increasing the system speed.

Applicants disagree. First, Ramankutty discloses a ternary CAM array, not a binary CAM array. A ternary CAM array is an array in which each row in the array stores a data value and a corresponding mask value. Ramankutty discloses a CAM including "a CAM array 102 having a plurality of CAM entries that can store data values and mask values" (col. 5, lines 21-25), and teaches that its "CAM array 102 can include a number of ternary CAM cells arranged into rows. Each ternary CAM cell can store a binary data value and corresponding mask value. A data value and corresponding mask value can be stored in a row of CAM cells" (col.5, lines 30-34). Thus, in contrast to the Examiner's assertion, Ramankutty fail to disclose or suggest a binary CAM array.

Second, Ramankutty does not disclose or suggest that each CAM array group includes a group global mask for storing a mask pattern indicative of priority. Rather, as discussed above, Ramankutty discloses a ternary CAM array in which each row stores both a data value and a mask value, and teaches that its CAM array "can be conceptualized as including a data array, which represents the various data values of the CAM array, and a mask array, which represents the various mask values of the CAM array" (col. 5, lines 35-39). Thus, in contrast to the Examiner's assertion, Ramankutty fails to disclose or suggest that each array group includes a group global mask.

Accordingly, Ramankutty fails to disclose or suggest "an array of binary CAM cells segmented into a plurality of array groups, each array group having a group global mask for storing a mask pattern indicating priority of the array group," as recited in Applicants' Claim 1, and therefore does not render Claim 1 obvious under 35 USC 103. Further, because Feldmeier also fails to disclose or suggest that each array group includes a group global mask, Claim 1 is not rendered obvious under 35 USC 103 by any combination of Feldmeier and Ramankutty.

Further, it is well settled that there must be some reason or motivation in the art to combine or modify references when making a prima facie case of obviousness under 35 USC 103. There is no need or reason to modify Feldmeier to include the teachings of Ramankutty, as proposed by the Examiner. As discussed above, Feldmeier teaches that "individual addresses have their masks added to them as they are inserted into the CAM memory array" (col. 12, lines 55-58), and Ramankutty teaches a "novel ternary CAM" (col. 5, lines 20-22) that includes rows of ternary CAM cells that can store a data value and a corresponding mask value (see col. 5, lines 30-39). Thus, modifying Feldmeier to include the teachings of Ramankutty would result in a segmented ternary CAM array in which each row of ternary CAM cells stores both a mask-encoded data value and an un-encoded mask value. Encoding a mask value into each data value (as taught by Feldmeier) while also separately storing the mask value in each row of data values (as taught by Ramankutty) seems redundant because the techniques taught by Feldmeier and Ramankutty perform similar functions, e.g., each technique allows data values having the same mask or prefix value to be updated within a corresponding address space or block without having to reorder the entries in the address space or block. Thus, modifying Feldmeier's CAM to include the ternary CAM cells of Ramankutty's CAM would undesirably increase circuit size and complexity without providing additional functionality, and therefore would not be desirable. Accordingly, because there is no reason to modify Feldmeier to include the teachings of Ramankutty, the combination of Feldmeier and Ramankutty is improper and does not support a prima facie case of obviousness under 35 USC 103. Thus, Claim 1 is patentable over Feldmeier and Ramankutty.

Claims 2-28 and 58 depend from Claim 1 and therefore distinguish over the cited references for at least the same reasons as Claim 1.

Claims 29-38

Applicants' Claim 29 recites:

A content addressable memory (CAM) system, comprising:

an array of binary CAM cells segmented into a plurality of array groups, each array group assigned a priority; and

a priority table including a plurality of rows, each for storing the priority of a corresponding array group.

The Examiner acknowledges that Feldmeier fails to disclose an "array of binary CAM cells segmented into a plurality of array groups, each array group assigned a priority, and each storing the priority of a corresponding array group," and then states:

> Ramankutty discloses the array of binary CAM cells segmented into a plurality of array groups (Fig. 1 Ref 108-1 to 108-5), each array group assigned a priority (col. 5 lines 25-30 and col. 10 lines 65+), and each storing the priority of a corresponding array group (col. 5, lines 25-30) for the purpose [of] providing capability of updating data values according to prefix length without having to re-order the entries in the CAM thereby increasing the system speed.

Applicants disagree. As discussed above with respect to Claim 1, Ramankutty does not disclose a binary CAM array, but rather teaches a ternary CAM array having a plurality of rows of ternary CAM cells that each store a data value and a corresponding mask value (see col. 5, lines 20-39). Thus, Ramankutty fails to disclose or suggest "an array of binary CAM cells segmented into a plurality of array groups," as recited in Claim 29, and therefore does not render Claim 29 obvious.

Further, because there is no reason or motivation in the art to modify Feldmeier to include the teachings of Ramankutty, as discussed above with respect to Claim 1, the Examiner's proposed combination of Feldmeier and Ramankutty is improper and does not support a prima facie case of obviousness under 35 USC 103. Accordingly, Claim 29 is patentable over Feldmeier and Ramankutty.

Claims 30-38 and 59 depend from Claim 29 and therefore distinguish over the cited references for at least the same reasons as Claim 29.

Claims 39-57

Claim 39 recites:

A method of operating a content addressable memory (CAM) system including an array of binary CAM cells segmented into a plurality of array groups, comprising:

assigning a priority to one or more array groups; and

selectively storing data in the array groups according to priority, wherein assigning the priority comprises:

for each array group, storing a mask pattern indicative of the priority assigned to the array group in a global mask for the array group.

As discussed above with respect to Claim 1, neither Feldmeier nor Ramankutty, whether taken alone or together, suggests an array of binary CAM cells segmented into a plurality of array groups, with each array group having a group global mask for storing a mask pattern indicating priority of the corresponding array group. Accordingly, neither Feldmeier nor Ramankutty suggests "storing a mask pattern indicative of the priority assigned to the array group in a global mask for the array group," as recited in Applicants' Claim 39. Therefore, Claim 39 is patentable over Feldmeier and Ramankutty.

Claims 40 and 42-57 depend from Claim 39 and therefore distinguish over the cited references for at least the same reasons as Claim 39.

Claims 60-72

Claim 60 recites:

A content addressable memory (CAM) comprising:

a plurality of CAM array groups each including a plurality of rows of binary CAM cells; and

a plurality of group global mask circuits each coupled to a corresponding one of the CAM array groups and each for storing a group global mask for globally masking one or more bits in all of the rows of CAM cells of the corresponding CAM array group, wherein each group global mask indicates a priority of the corresponding group of CAM cells relative to other CAM array groups.

As discussed above with respect to Claim 1, neither Feldmeier nor Ramankutty, whether taken alone or together, suggests "a plurality of CAM array groups each including a plurality of rows of binary CAM cells" and "a plurality of group global mask circuits each coupled to a corresponding one of the CAM array groups and each for storing a group global mask for globally masking one or more bits in all of the rows of CAM cells of the corresponding CAM array group," as recited in Claim 60. Therefore, Claim 60 is patentable over Feldmeier and Ramankutty.

Claims 61-72 depend from Claim 60 and therefore distinguish over the cited references for at least the same reasons as Claim 60.

Claims 73-84

Claims 73-84 are allowed.

<u>Claims 85-88</u>

Claim 85 recites:

A content addressable memory (CAM) comprising:

a plurality of CAM array groups each including a plurality of rows of binary CAM cells each coupled to a corresponding match line;

a plurality of group global mask circuits each coupled to a corresponding one of the array groups and each for storing a group global mask for globally masking one or more bits in all of the rows of binary CAM cells of the corresponding array group; and

an index circuit coupled to the match lines to determine, as between rows of CAM cells in different array groups that contain data matching a search key as masked by their corresponding group global masks, an index of one of the rows of CAM cells that contains the data matching the search key, wherein one of the rows of CAM cells has a corresponding group global mask that masks fewer bits than the other group global masks associated with the other rows of CAM cells that store data matching the search key.

As discussed above with respect to Claim 1, neither Feldmeier nor Ramankutty, whether taken alone or together, suggests "a plurality of CAM array groups each including a plurality of rows of binary CAM cells each coupled to a corresponding match line" and "a plurality of group global mask circuits each coupled to a corresponding one of the array groups and each for storing a group global mask for globally masking one or more bits in all of the rows of binary CAM cells of the corresponding array group," as recited in Claim 85. Therefore, Claim 85 is patentable over Feldmeier and Ramankutty.

CONCLUSION

In light of the above remarks, it is believed that Claims 1-40 and 42-88 are in condition for allowance and, therefore, a Notice of Allowance of Claims 1-40 and 42-88 is respectfully requested. If the Examiner's next action is other than allowance as requested, the Examiner is requested to call the undersigned at (415) 291-9497.

Respectfully submitted,

Dated: <u>October 7, 2003</u>

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